Complete Summary

GUIDELINE TITLE

Staging of bronchogenic carcinoma, non-small cell and small cell lung carcinoma.

BIBLIOGRAPHIC SOURCE(S)

Rozenshtein A, Davis SD, Ritsuko RU, Bradley JD, Gopal RS, Haramati LB, McLoud TC, Movas B, Rosenzweig KE, White CS, Kaiser LK, Schiller JH, Expert Panel on Thoracic Imaging and Radiation, Oncology-Lung Work Group. Staging of bronchogenic carcinoma, non-small cell and small cell lung carcinoma. [online publication]. Reston (VA): American College of Radiology (ACR); 2005. 9 p. [42 references]

GUIDELINE STATUS

This is the current release of the guideline.

This updates two previously published versions: McLoud TC, Westcott J, Davis SD, Fleishon H, Gefter WB, Henschke CI, Pugatch RD, Sostman HD, Tocino I, White CS, Yankelevitz D, Bode FR. Staging of bronchogenic carcinoma, non-small cell lung carcinoma. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215 (Suppl):611-9 and Ko B, Sause WT, Byhardt RW, Curran WJ, Fuller D, Graham MV, Komaki R, Weisenburger TH, Kaiser LR, Leibel SA, Brown RC. Staging of non-small cell lung carcinoma. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215(Suppl):1281-94.

The appropriateness criteria are reviewed annually and updated by the panels as needed, depending on introduction of new and highly significant scientific evidence.

COMPLETE SUMMARY CONTENT

SCOPE

DISEASE/CONDITION(S)

Bronchogenic carcinoma, non-small cell and small cell lung carcinoma

GUIDELINE CATEGORY

Diagnosis
Evaluation

CLINICAL SPECIALTY

Internal Medicine
Nuclear Medicine
Oncology
Pulmonary Medicine
Radiology

INTENDED USERS

Health Plans
Hospitals
Managed Care Organizations
Physicians
Utilization Management

GUIDELINE OBJECTIVE(S)

To evaluate the appropriateness of initial radiologic examinations for patients with bronchogenic carcinoma, non-small cell and small cell lung carcinoma

TARGET POPULATION

Patients with bronchogenic carcinoma, non-small cell and small cell lung carcinoma

INTERVENTIONS AND PRACTICES CONSIDERED

1. X-ray
    - Posterior-anterior (PA), chest
    - Lateral
2. Computed tomography (CT)
    - Thorax (including adrenal glands)
    - Abdomen
    - Brain
3. Magnetic resonance imaging (MRI)
    - Brain
    - Thorax
4. Fluorodeoxyglucose-positron emission tomography (FDG-PET)

5. Nuclear medicine (NUC), bone scintigraphy

MAJOR OUTCOMES CONSIDERED

Utility of radiologic examinations in staging of bronchogenic carcinoma

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

The guideline developer performed literature searches of peer-reviewed medical journals, and the major applicable articles were identified and collected.

NUMBER OF SOURCE DOCUMENTS

The total number of source documents identified as the result of the literature search is not known.

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Weighting According to a Rating Scheme (Scheme Not Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Not stated

METHODS USED TO ANALYZE THE EVIDENCE

Systematic Review with Evidence Tables

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

One or two topic leaders within a panel assume the responsibility of developing an evidence table for each clinical condition, based on analysis of the current literature. These tables serve as a basis for developing a narrative specific to each clinical condition.

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus (Delphi)

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

Since data available from existing scientific studies are usually insufficient for meta-analysis, broad-based consensus techniques are needed for reaching agreement in the formulation of the appropriateness criteria. The American College of Radiology (ACR) Appropriateness Criteria panels use a modified Delphi technique to arrive at consensus. Serial surveys are conducted by distributing questionnaires to consolidate expert opinions within each panel. These questionnaires are distributed to the participants along with the evidence table and narrative as developed by the topic leader(s). Questionnaires are completed by the participants in their own professional setting without influence of the other members. Voting is conducted using a scoring system from 1 to 9, indicating the least to the most appropriate imaging examination or therapeutic procedure. The survey results are collected, tabulated in anonymous fashion, and redistributed after each round. A maximum of three rounds is conducted and opinions are unified to the highest degree possible. Eighty percent agreement is considered a consensus. This modified Delphi technique enables individual, unbiased expression, is economical, easy to understand, and relatively simple to conduct.

If consensus cannot be reached by this Delphi technique, the panel is convened and group consensus techniques are utilized. The strengths and weaknesses of each test or procedure are discussed and consensus reached whenever possible. If "No consensus" appears in the rating column, reasons for this decision are added to the comment sections.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Not applicable

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

Internal Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Criteria developed by the Expert Panels are reviewed by the American College of Radiology (ACR) Committee on Appropriateness Criteria.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

ACR Appropriateness Criteria®

Clinical Condition: Staging of Bronchogenic Carcinoma

Variant 1: Non-Small Cell Lung Carcinoma

Radiologic Exam Procedure	Appropriateness Rating	Comments
CT, thorax (including adrenal glands)	9	
X-ray, chest, PA and lateral	8	
FDG PET	8	
MRI, brain	7	Particularly if neuro symptoms are present
CT, abdomen	5	
CT, brain	5	If MRI contraindicated and neuro symptoms are present
NUC, bone scintigraphy	5	Not necessary if PET has been done.
MRI, thorax	3	Useful for evaluating chest wall invasion and for local staging of superior sulcus tumors.
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1 = Least appropriate 9 = Most appropriate		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Variant 2: Small Cell Lung Carcinoma

Radiologic Exam Procedure	Appropriateness Rating	Comments
X-ray, chest, PA and lateral	9	
CT, thorax (including adrenal glands)	9	
MRI, brain	8	
FDG PET	7	
CT, abdomen	5	
CT, brain	5	If MRI contraindicated and neuron symptoms are present
NUC, bone	5	Not necessary if PET has been done.

Radiologic Exam Procedure	Appropriateness Rating	Comments
scintigraphy		
MRI, thorax	2	
Appropriateness Criteria Scale 1 2 3 4 5 6 7 8 9 1 = Least appropriate 9 = Most appropriate		

Note: Abbreviations used in the tables are listed at the end of the "Major Recommendations" field.

Non-Small Cell Lung Carcinoma

Staging

Staging of any tumor is done to determine the extent of disease. Staging information is important for two reasons: 1) to determine prognosis and 2) to select patients for surgical intervention and/or a different modality. The TNM system is widely used to classify lung tumors. In 1986, the staging system was revised on the basis of epidemiologic evidence of improved survival after surgical resection in patients who had previously been classified as having unresectable disease. In the TNM classification, "T" indicates the features of the primary tumor, "N" indicates metastasis to regional lymph nodes, and "M" refers to the presence or absence of distant metastases (Tables 1 and 2 of the original guideline document). In the old (pre 1985) lung cancer classification, stage I and II tumors were considered amenable to surgical management, and stage III tumors were considered unresectable. The revised 1985 system and the current Mountain classification consist of four stages: stage IV includes only those patients with evidence of distant metastasis (M1). Stage III has been redefined and divided into stages IIIa and IIIb. Of these two categories, stage IIIb is also considered unresectable disease. In the previous classification, tumors with limited invasion of the chest wall and mediastinum were included in this inoperable category, but under the new classification, such tumors are considered to be potentially resectable provided that vital structures in the mediastinum, such as the great vessels, heart, and aerodigestive tract, are not involved. The designation T4 is now used to describe lesions with extensive invasion of the mediastinum or diaphragm. In addition in the current system, patients with ipsilateral nodal metastasis are also considered to have resectable cancer. However, for the most part, only patients with limited ipsilateral mediastinal nodal disease fall into the operable category. These are usually cases in which the tumor is contained within the capsule of the lymph nodes and is limited to involvement of the lower mediastinal nodes. The category N3 was added to the TNM staging to refer to contralateral mediastinal or hilar lymph node or supraclavicular lymph node metastasis. N3 disease is considered to be in the nonsurgical or unresectable category.

In 1997, further revisions were introduced into the staging grouping of the TNM subsets in the International System for Staging Lung Cancer. This was adopted by the American Joint Committee on Cancer and the Union Internationale Contre le

Cancer. The changes from the previous classification are minor. Stage I has been divided into two groups: IA and IB. T4 has also been slightly redefined to include satellite tumor nodule(s) within the ipsilateral primary lobe of the lung. Previously, any additional nodules had been considered evidence of distant metastatic disease (M1). The definitions of stages IIA, IIB, IIIA, and IIIB are included in Table 2 of the original guideline document. In regard to stage I, data have consistently shown a better outcome for patients with T1N0M0 lung tumors than for any other subsets. Survival is estimated to be approximately 60% in patients with clinical stage IA disease and only 38% for those in clinical stage IB. Stage IB is designated as patients with T2 tumors. Regarding stage II, the survival rate for patients with T1N1M0 disease, that is, T1 lesions with involved hilar nodes, is higher than for those with T2N1M0 disease. However, the former is a small group of patients, who are encountered rather infrequently. Definitions for stage IIIA and IIIB are provided in Table 2 of the original guideline document.

A number of imaging modalities have historically been used in staging lung cancer. These have included standard and conventional tomography as well as CT and MRI. In some instances, accurate staging and the determination of appropriate treatment for patients with lung cancer can be made noninvasively with imaging modalities alone, although in most cases, some degree of surgical staging and biopsy evidence is also necessary.

Chest Radiographs - PA and Lateral

The need for appropriateness guidelines for routine chest radiographs in lung cancer appears to be a non-issue. The vast majority of primary lung cancers are initially detected on routine chest radiographs. There may be certain instances in which the chest radiograph alone is a sufficient imaging procedure for staging - for example, when an obvious metastatic bone lesion is detected or when large bulky contralateral mediastinal lymph nodes are present. However, numerous studies have shown that the chest radiograph lacks sensitivity in detecting mediastinal lymph node metastases and in detecting chest wall and mediastinal invasion.

Computed Tomography

CT has now become the major imaging modality of choice in the evaluation of patients with bronchogenic carcinoma. Numerous studies have shown that the value of CT in staging is limited, because there are no morphologic criteria that would allow distinction between benign and malignant lymph nodes. It is certainly more sensitive than standard radiography, however, and it may serve as a guide to surgical management and in the determination of appropriate methods for surgical staging.

Traditionally, chest CT for staging of lung cancer is extended into the abdomen to include the adrenal glands. Whether this requires intravenous contrast material is debatable. The recent work of one study addressed the question of whether administration of intravenous contrast material at CT of the thorax and upper abdomen (including the liver) changed the tumor stage and management compared with nonenhanced helical CT in 96 patients with newly diagnosed lung cancer. Although four of these patients were either upstaged or downstaged after intravenous contrast administration, there was no change in management. The

authors concluded that contrast-enhanced CT extended to include the liver rarely adds to routine nonenhanced CT through the adrenal glands and does not influence management decisions.

Evaluation of Primary Tumor (the T Factor)

It is not always possible to distinguish T3 from T4 lesions with imaging studies. Lesions with chest wall invasion are classified as T3 lesions and are potentially resectable. Surgical resection, however, requires an en bloc resection of the pulmonary malignancy and the contiguous chest wall and is associated with an operative mortality in the range of 8 to 15%. It is usually desirable, therefore, to determine preoperatively if chest wall invasion is present in order to select patients as operative candidates. Although CT certainly provides information incrementally superior to that of radiographs, many of the findings described in the literature that are said to be associated with chest wall invasion have been shown to be neither sensitive nor specific. One study demonstrated a sensitivity of only 62% for CT in distinguishing T3 to T4 tumors from T0 to T2 tumors. Similarly, another study found CT to be of limited value assessing chest wall invasion, with a sensitivity of 87% and specificity of only 59%. CT was found to be more specific in assessing chest pain (94%). Some of the signs that have been described include pleural thickening adjacent to the tumor, encroachment on or increased density of subpleural fat, or an obtuse angle between the pulmonary mass and the pleural surface. Only the presence of a mass in the chest wall or definite rib destruction are helpful indicators of chest wall invasion.

Similarly, CT may be useful when extensive mediastinal invasion is present. Contrast-enhanced images may show vascular encasement and involvement of major mediastinal organs. However, CT is unable in some instances to distinguish contiguity of tumor with the mediastinum from actual invasion of the walls of vital mediastinal structures. In one study the sensitivity of CT depended on the sign of mediastinal invasion that was used. It was only 40% for 90 degrees of contact between the mass and the mediastinal structure, and 44% if distortion of the mediastinal structure was present. Positive predictive values were low, and these authors concluded that CT was not useful in determining mediastinal invasion. Another study used pneumothorax combined with CT to determine the presence of chest wall and mediastinal invasion by lung cancer. Although the sensitivity and specificity are both high, the study included only a small number of cases, and the technique is invasive.

Evaluation of Nodal Metastasis (the N Factor)

CT has become the method of choice for assessing mediastinal nodes in bronchogenic carcinoma. Previously, patients with mediastinal nodal metastasis from bronchogenic carcinoma were not considered to benefit from surgery. However, numerous studies have consistently documented improved survival of selected patients after resection of mediastinal nodal disease and, in most cases, adjuvant radiation therapy. The new American Joint Committee on Cancer Staging now considers patients with ipsilateral mediastinal lymph node metastasis (N2) as potentially surgically resectable stage IIIa disease. Included in this group are patients with 1) intracapsular rather than extracapsular involvement and 2) positive nodes identified at thoracotomy after negative mediastinoscopy. In addition, early reports have indicated that even patients with gross and bulky

ipsilateral nodal metastasis (N2) may benefit from surgery if it is combined with neoadjuvant chemotherapy and radiation therapy. However, patients with contralateral mediastinal nodal involvement (N3) are considered to have unresectable stage IIIb disease.

Several studies have addressed the accuracy of CT in the staging of mediastinal nodal metastasis in lung cancer. More recent studies that have used total nodal sampling and the American Thoracic Society Lymph Node Classification have generally shown a lower sensitivity of CT in detecting nodal metastasis. One study reported that the sensitivity and specificity of CT were 64% and 62%, respectively. This study used 1 cm as the upper limit of normal diameter for the short axis of lymph nodes and also used extensive lymph node sampling that was correlated closely with CT nodal stations. Another study used similar methodology and showed a somewhat higher sensitivity of 79%, which approached that of mediastinoscopy. However, they used the long axis for lymph node measurement. They concluded that CT and mediastinoscopy were complementary, particularly because CT often showed enlargement of lymph nodes in groups that were inaccessible at mediastinoscopy. But another study found that in detecting mediastinal nodal metastasis, CT had a sensitivity of 81% with central tumors and 71% with peripheral tumors. The negative predictive index, however, was 93%. Based on this figure, they suggested that mediastinoscopy is not necessary when the CT scan is negative. However, they did recommend careful nodal sampling at the time of thoracotomy. Their study suffered from the fact that a nodal sampling scheme was not used in correlating radiologic and pathologic findings.

The recent meta-analysis of the mediastinal staging by CT evaluated twenty studies dated 1991 through 2001 with a total of 3,438 patients, with the vast majority using the short axis diameter >10 mm as the criterion for nodal positivity. Citing marked heterogeneity of the individual studies, the authors reported the pooled sensitivity and specificity of CT scanning as 57% and 82%, respectively, while the overall positive predictive value (PPV) and negative predictive value (NPV) of CT scanning were 56% and 86%, respectively. Furthermore, the authors concluded there was no demonstrable improvement in accuracy over the past decade in spite of advances in CT technology.

In summary, controversy still exists about the value of CT scanning in staging the mediastinum in lung cancer. A negative CT scan for mediastinal adenopathy may provide useful information, particularly in institutions in which mediastinoscopy may not be available or preferred. If patients are selected immediately for thoracotomy without preceding mediastinoscopy, careful nodal sampling must be done at the time of surgery. Because of the low specificity of CT, enlarged lymph nodes must be biopsied for accurate staging. Despite the limited sensitivity and specificity of CT, it is used almost universally for staging the mediastinum in lung cancer. This use appears to be appropriate because of the additional information it provides, such as a map of enlarged nodes prior to mediastinoscopy, as well as information on enlarged nodes that are out of reach of the mediastinoscope or that are contralateral in position and suspect for N3 disease.

The issue of CT staging of the mediastinum in T1 lesions is controversial. T1 tumors are defined as lesions <3 cm in greatest diameter surrounded by lung or visceral pleura without evidence of invasion proximal to the lobar bronchus. Several studies have suggested a low prevalence of mediastinal nodal metastatic

disease with T1 cancers (5%-15%). Because of this low prevalence, it has been suggested that CT may not be necessary in such patients and that the preoperative staging should be limited to plain chest radiographs. However, one study found a 21% prevalence of nodal metastasis among 104 patients with T1 lesions. The sensitivity of CT was 77% for detecting these metastases, and the study's authors recommended that CT be performed in such patients. Another study of 23 patients with T1 lesions found only one patient who had CT evidence of noncurative disease. Because of the low yield, CT was not recommended. In a larger series of 63 patients, the authors found that 14% of patients with T1 lung cancers had inoperable disease correctly detected by CT. However, in this study pathologic proof of inoperability was lacking. In summary, the issue remains controversial, and none of the studies appears to be definitive.

Evaluation of Distant Metastasis (the M Factor)

The role of CT in determining extrathoracic metastasis from bronchogenic carcinoma is also controversial. There appears to be general agreement that CT of the thorax should include the adrenal glands, which are a frequent site of metastases from non-small cell lung cancer. In a study of 91 autopsy-proven adrenal metastases from lung cancer, the authors found that the sensitivity of CT was low (41%) but that the specificity was high (99%). They recommended CT but noted that patients with a negative CT had a 30% likelihood of adrenal metastasis. The other potential problem with screening the adrenal glands is the nonspecificity of the findings. This problem has been documented in later studies. Another study looked at 330 patients with bronchogenic carcinoma, 33 of whom had adrenal masses. Only 25% had metastatic disease, and the remainder had adenomas. Adenomas can often be distinguished from metastasis by their smaller size and low attenuation values. However, in many cases, additional imaging with MRI or percutaneous biopsy is necessary for diagnosis. A similar study confirmed the nonspecificity of adrenal masses in patients with non-adrenal primaries.

Bone scintigraphy in the detection of metastatic disease has significant limitations. Although it has high sensitivity, it is noted for very low specificity that ranges from 50 to 60%. Bone scintigraphy should probably be limited to cases in which patients have specified clinical indicators of bone metastasis. Routine cerebral imaging in the form of CT is recommended only for patients with stage III disease, particularly those with adenocarcinoma and large cell carcinoma cell types.

Magnetic Resonance Imaging

Initial experience suggests that evaluation of the mediastinum with MRI is approximately equal to that of CT with regard to the staging of bronchogenic carcinoma. However, one study showed that MRI was significantly more accurate for detecting direct mediastinal invasion. Other studies have confirmed the usefulness of MRI, particularly in the evaluation of chest wall invasion and the local staging of superior sulcus tumors. One study showed an accuracy of MRI of 94% compared with 63% for CT in determining tumor invasion through the superior sulcus. Similarly, another study showed that T1-weighted images had 90% sensitivity and 86% specificity in detecting chest wall invasion by lung cancer. MRI is particularly useful in determining certain parameters of unresectability for superior sulcus cancers, such as invasion of the vertebral body

and involvement of the subclavian artery and brachial plexus. The general conclusion of these studies is that MRI has advantages in the assessment of both chest wall and mediastinal invasion.

Positron Emission Tomography

Initial studies of PET imaging in lung cancer using 18-FDG has been proven it to be clinically useful. In a study of 100 patients, PET showed sensitivity and specificity >70% for hilar nodes and >90% for mediastinal nodes. Of particular interest was the fact that the negative predictive value of PET was high, suggesting that a normal PET scan might obviate the need for mediastinoscopy in these patients. In another study comparing PET and CT, sensitivities and specificities of >80% were achieved with PET, compared with CT sensitivity of 64% and specificity of 44%. In another study, 47 patients suspected of having newly diagnosed non-small cell lung cancer were evaluated with both CT and PET scanning, and each imaging study was evaluated separately, with nodal stations localized according to the American Thoracic Society mapping system. The sensitivities of PET and CT were 89% and 57%, respectively. Specificities were 99% and 94%, respectively. PET had a negative predictive value of 97%. All of these studies suggest a superiority of PET over CT for nodal staging of non-small cell lung cancer.

In a more recent study involving 100 patients, PET staging was accurate in 83% of patients, while conventional imaging staging was accurate in 65% of them. PET correctly staged mediastinal lymph nodes in 85% of patients vs. 58% for CT. In an even larger group (167 patients) with non-small cell lung cancer staged by conventional imaging, PET detected otherwise unexpected distant metastases in 18% of patients with stage II disease and 24% of patients with stage III disease, prompting the authors to conclude that PET staging was indicated for radical radiation therapy candidates. The multicenter randomized PLUS (PET in lung cancer) trial, comparing a group of 96 patients staged with conventional workup with a group of 92 patients staged with both conventional workup and PET, concluded that "addition of PET to conventional workup prevented unnecessary surgery in one out of five patients with suspected non-small cell lung cancer."

The large body of evidence prompted several meta-analyses of the existing data. In a comprehensive review of current evidence, one meta-analysis pooled 18 studies conducted between 1994 and 2001 with the total of 1,045 evaluable patients. The authors found that the summary receiver operating characteristic (ROC) curve was significantly more accurate for PET than for CT ($p<0.001$), with a pooled sensitivity of 88% and a sensitivity of 89%. The PPV and NPV were 79% and 93%, respectively.

Availability of PET has improved dramatically in recent years. With over 1,000 cameras installed in North America in 2004, it is now feasible to include PET in the routine staging of lung carcinoma. Indications for whole body FDG PET in patients with non-small cell lung cancer include high clinical index of suspicion, high grade malignancy, and radiographic evidence of nodal enlargement. In addition, PET may be helpful in centers where mediastinoscopy is not readily available and in patients with significant comorbid conditions who are borderline candidates for surgery, with locally advanced disease, solitary brain metastasis, and cases of local recurrence that might qualify for reoperation.

Small Cell Lung Carcinoma

According to the recent analysis of the Surveillance, Epidemiology, and End Results database, small cell lung cancer (SCLC) now accounts for about 14% of all new cases of lung cancer. It is more aggressive than the non-small cell form, with median survival of 2-4 months if untreated. Although the TNM staging system has been useful, the alternative staging system widely applied is a two-stage system based on studies of the Veterans Administration Lung Study Group. In this system, patients are classified as having either limited disease (i.e., tumor confined to one hemithorax and to the regional lymph nodes) or extensive disease (i.e., tumor beyond this area in contralateral lung or extrathoracic sites). Extensive disease is present in 60 to 80% of patients newly diagnosed with SCLC. Conventional staging for extrathoracic metastasis in patients with SCLC includes CT of the abdomen, CT or MRI of the head, and bone scintigraphy. A bone marrow biopsy may be omitted for patients with normal blood counts, normal lactate dehydrogenase level, and negative result on bone scan. Other routine staging procedures include liver function tests and complete blood counts.

Noninvasive imaging is generally recommended only in patients who have abnormal routine screening tests. One study compared CT and ultrasound (US) in staging the abdomen in patients with SCLC. They found that CT was more sensitive than US and showed 50% of patients with extensive disease compared with 39% by US. Twenty percent of patients were restaged as a result of the CT findings. These authors, however, recommended that CT of the abdomen only be performed in patients with biochemical abnormalities. In regard to the search for central nervous system (CNS) metastasis, again the recommendation is that routine brain CT or MRI only be done for patients involved in clinical study protocols. The remainder should be limited to patients with symptomatic or clinically detectable CNS metastasis. Another study attempted to determine the value of routine CT of the brain in patient with SCLC compared to neurologic findings. Of a total of 57 patients, both with and without neurologic symptoms, only four had brain metastasis, and three of these patients had the metastasis confirmed by CT. In the one negative patient, CT was later found to be positive. All of these patients were symptomatic or had positive neurologic examinations. Of the 54 non-neurologically symptomatic patients, no metastases were detected on CT.

As with NSCLC, skeletal metastasis may be evaluated with bone scanning. Although highly sensitive, bone scanning has a low specificity in SCLC, as it does in NSCLC. Screening is best limited to patients with symptoms or abnormal biochemical profiles. A preliminary study of 25 patients examined the value of MRI in staging SCLC. The MRI resulted in a change in staging in 5 of the 25 patients. These patients were found to have extensive disease. Additional metastases were found in the bone and liver as a result of the MRI. However, details on the clinical studies on these patients are not available in this study, and the work appears to be too preliminary to allow any recommendation on the use of MRI in the staging of SCLC.

Several new prospective studies addressed the utility of PET in staging SCLC, each in a relatively small group of patients. All concluded that FDG-PET has high sensitivity for SCLC and appears to be of value in staging SCLC. In a larger prospective series, FDG-PET caused stage migration in 14 of 120 patients, with 10

being correctly upstaged and 3 correctly downstaged. All stage changes affected management. Only one patient was incorrectly staged by PET due to failure to detect brain metastases. In this study, the sensitivity of FDG-PET was found to be significantly superior to that of CT in the detecting extrathoracic lymph node involvement (100% vs. 70%) and distant metastases except to the brain (98% vs. 83%). PET was significantly less sensitive than CT/MR for detecting brain metastases (46% vs. 100%). Although these results appear promising, more data are needed to unequivocally establish the role of PET in staging SCLC.

Abbreviations

- CT, computed tomography
- FDG PET, fluorodeoxyglucose positron emission tomography
- MRI, magnetic resonance imaging
- NUC, nuclear medicine
- PA, posteroanterior

CLINICAL ALGORITHM(S)

Algorithms were not developed from criteria guidelines.

EVIDENCE SUPPORTING THE RECOMMENDATIONS

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The recommendations are based on analysis of the current literature and expert panel consensus.

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Selection of appropriate radiologic imaging procedures for evaluation of patients with bronchogenic carcinoma, non-small cell and small cell lung carcinoma

POTENTIAL HARMS

Not stated

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

An American College of Radiology (ACR) Committee on Appropriateness Criteria and its expert panels have developed criteria for determining appropriate imaging examinations for diagnosis and treatment of specified medical condition(s). These criteria are intended to guide radiologist, radiation oncologist, and referring physicians in making decisions regarding radiologic imaging and treatment. Generally, the complexity and severity of a patient's clinical condition should

dictate the selection of appropriate imaging procedures or treatments. Only those exams generally used for evaluation of the patient's condition are ranked. Other imaging studies necessary to evaluate other co-existent diseases or other medical consequences of this condition are not considered in this document. The availability of equipment or personnel may influence the selection of appropriate imaging procedures or treatments. Imaging techniques classified as investigational by the U.S. Food and Drug Administration (FDA) have not been considered in developing these criteria; however, study of new equipment and applications should be encouraged. The ultimate decision regarding the appropriateness of any specific radiologic examination or treatment must be made by the referring physician and radiologist in light of all the circumstances presented in an individual examination.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

IMPLEMENTATION TOOLS

Personal Digital Assistant (PDA) Downloads

For information about availability, see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Living with Illness

IOM DOMAIN

Effectiveness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

Rozenshtein A, Davis SD, Ritsuko RU, Bradley JD, Gopal RS, Haramati LB, McLoud TC, Movas B, Rosenzweig KE, White CS, Kaiser LK, Schiller JH, Expert Panel on Thoracic Imaging and Radiation, Oncology-Lung Work Group. Staging of bronchogenic carcinoma, non-small cell and small cell lung carcinoma. [online publication]. Reston (VA): American College of Radiology (ACR); 2005. 9 p. [42 references]

ADAPTATION

Not applicable: The guideline was not adapted from another source.

DATE RELEASED

1996 (revised 2005)

GUIDELINE DEVELOPER(S)

American College of Radiology - Medical Specialty Society

SOURCE(S) OF FUNDING

American College of Radiology (ACR) provided the funding and the resources for these ACR Appropriateness Criteria®.

GUIDELINE COMMITTEE

Committee on Appropriateness Criteria, Expert Panel on Thoracic Imaging and Radiation Oncology-Lung Work Group

COMPOSITION OF GROUP THAT AUTHORED THE GUIDELINE

Panel Members: Anna Rozenshtein, MD (Principal Author); Sheila D. Davis, MD (Panel Chair); Ritsuko U. Komaki, MD (Lung Work Group Panel Chair); Jeffrey D. Bradley, MD; Ramesh S. Gopal, MD; Linda B. Haramati, MD; Theresa C. McLoud, MD; Benjamin Movas, MD; Kenneth E. Rosenzweig, MD; Charles S. White, MD; Larry R. Kaiser, MD ; Joan H. Schiller, MD

FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

Not stated

GUIDELINE STATUS

This is the current release of the guideline.

This updates two previously published versions: McLoud TC, Westcott J, Davis SD, Fleishon H, Gefter WB, Henschke CI, Pugatch RD, Sostman HD, Tocino I, White CS, Yankelevitz D, Bode FR. Staging of bronchogenic carcinoma, non-small cell lung carcinoma. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215 (Suppl):611-9 and Ko B, Sause WT, Byhardt RW, Curran WJ, Fuller D, Graham MV, Komaki R, Weisenburger TH, Kaiser LR, Leibel SA, Brown RC. Staging of non-small cell lung carcinoma. American College of Radiology. ACR Appropriateness Criteria. Radiology 2000 Jun;215(Suppl):1281-94.

The appropriateness criteria are reviewed annually and updated by the panels as needed, depending on introduction of new and highly significant scientific evidence.

GUIDELINE AVAILABILITY

Electronic copies: Available in Portable Document Format (PDF) from the American College of Radiology (ACR) Web site.

ACR Appropriateness Criteria® Anytime, Anywhere™ (PDA application). Available from the ACR Web site.

Print copies: Available from the American College of Radiology, 1891 Preston White Drive, Reston, VA 20191. Telephone: (703) 648-8900.

AVAILABILITY OF COMPANION DOCUMENTS

The following is available:

- ACR Appropriateness Criteria®. Background and development. Reston (VA): American College of Radiology; 2 p. Electronic copies: Available in Portable Document Format (PDF) from the American College of Radiology (ACR) Web site.

PATIENT RESOURCES

None available

NGC STATUS

This NGC summary was completed by ECRI on March 6, 2006.

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